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AN ANALYTICAL KEY TO SOME OF THE SEGREGATES OF OENOTHERA.

BY REGINALD R. GATES.

This little key is published with the idea of aiding botanists in America and Europe, who have no special knowledge of or acquaintance with the forms concerned, in identifying some of the recent segregates and mutants of *Oenothera* as they are now recognized on the basis of the pedigree cultures of recent years. Since some of these forms, such as *O. grandiflora*, are known still to occur in the wild condition, and since some of them are liable to be discovered at any time in a new locality, it is important that botanists in general should have available a brief analytical key with mention of the chief differentiating characters and references to some of the best illustrations and descriptions of the various forms.

As an instance of the necessity for this may be mentioned a recent experience of the writer, whose attention was called to a large flowered evening primrose growing in the back yard of a citizen of Saint Louis, Mr. Ernest F. Aehle, 5143 Page Avenue. The large flowers attracted attention and a specimen was brought for identification. An examination of the plant showed that it is very probably a form or derivative of *O. grandiflora*. This plant is at present only known from two localities in Alabama, and the source from which this particular specimen reached its present location is quite unknown. But it is by no means unlikely that search by botanists and collectors will reveal its presence in various parts of the country. Probably the most likely location in which to look for *O. grandiflora* is in the States of the Middle South. I may say that cultures of some English *Oenotheras* growing wild near Liverpool, an account of which is as yet unpublished,* show that various races of *O. grandiflora*, as well as *O. Lamarckiana* and its derivatives, occur in that locality.

* See Proceedings British Assoc. Adv. Sci., Sec. K. Winnipeg meeting, 1909.

It is hoped that this key will aid botanists in the identification, approximately at least, of these forms, and will lead to an increased interest among collectors in the search for these types throughout North America and Europe. Of course the present key is very incomplete and it would be desirable to add many forms to the list, but these can be added as our knowledge of the forms becomes more accurate through the medium of pedigree cultures.

Even though the forms which will be discovered are found to have been introduced or escaped from gardens, a comparison of the types from various stations as they occur under such conditions is of interest, as I have already found from my cultures of the Liverpool *Oenotheras*. The study and comparison of such areas will lead to results of the greatest interest and importance bearing on such problems as the effects of climatic conditions after long periods. The *Oenotheras*, on account of their weed-like character, are of peculiar value from this standpoint, because their habit of preempting deserted areas and multiplying rapidly makes each such patch or locality equivalent to a transplantation experiment in which the success or failure of the various mutants and segregates, and the changes they have undergone under the conditions of the struggle, can be noted and analyzed.

It is a good example of the occasional vagaries of systematic botany that *O. grandiflora* should have been so long considered a mere "large-flowered variety" of *O. biennis*, while in reality it is at least as distinct from *O. biennis* as is *O. Lamarckiana*. Though *O. grandiflora* and *O. Lamarckiana* come in the same sub-group of the *Onagra* series, they are distinct from each other in a great many characters, and both appear undoubtedly to be good "Linnean" species. What the relation of such large-flowered forms as *O. Hookeri* and *O. Drummondii* is to *O. biennis* and *O. grandiflora*, I am not at present prepared to indicate. The difference between the small-flowered forms, with short style, such as *O. biennis*, and the large flowered forms with long style, such as *O. grandiflora*, is probably the most distinct line of cleavage in the sub-genus *Onagra*.

The following key is prepared largely from the characters of the plants as they have appeared in my own cultures. The only exceptions are *O. argillicola*, the account of which is taken from MacDougal, Carnegie Pub. 24: 11. *pl.* 7. 1905, and Mackenzie, Notes on evening primroses, (Torreya, 4: 56-57), 1904; *O. Simsiana*, *O. Oakesiana*, *O. muricata* and *O. parviflora*, the account of which is from Vail, Carnegie Pub. 81. 1907; and *O. elliptica*, *O. sublinearis*, and *O. scintillans*, which I have not grown, and for which the description has been taken from DeVries' account. DeVries, in his Mutationstheorie, 2: 322-328, has already prepared several keys to the mutants, based respectively on seedling characters; height and branching of plants; leaves; and flowers, fruits and seeds. In the following key, characters are chosen from all the stages of development, and, as far as possible, from those which are most likely to be encountered by a botanist in the field. The selection of differentiating characters under these circumstances is a difficult one and I am not sure that the choice I have made is always the best. But short descriptions, enumerating the chief distinctive features of the various forms, are appended for aid in case the stages chosen in the keys are not available, or the distinctions drawn are not sufficiently clear. References are also given to some of the most accurate figures of the different species.

It should be said that in the case of the mutants from *O. Lamarckiana*, occasional specimens appear which transgress in one or more characters any line which can be drawn between related forms. Usually, however, the forms fit very well the descriptions given them.

There is no attempt to cite the extensive literature of the genus here. A systematic treatment was published by Small* in 1896, and a monograph by L  veill  † in 1902 and 1905.

* Small, John K. *Oenothera and its segregates*. (Bull. Torr. Bot. Club. 23: 167-194). 1896.

† L  veill  , H. *Monographie du genre Oenothera*. Le Mans. 1902 and 1905.

GENERAL KEY.

Petals cruciate, narrow and linear.

O. cruciata.

This probably includes a number of sub-forms. Cruciate varieties of *O. Lamareckiana* and of European *O. biennis*, as well as of other forms, are also known. See DeVries, Die Mutationstheorie. 2 : 593-633.

Petals broad; flowers small, about 3 cm. in diameter; petals about 13-15 mm. long; style short, so that the anthers surround the stigma lobes and ensure self-pollination in the bud.

Sepal tips appressed; capsule not taper, often stouter near the middle. *O. biennis* and its segregates.

Sepal tips spreading; capsule long and taper. *O. Oakesiana.*

Petals broad; flowers smaller than in *O. biennis*; stigma situated below the anthers in the bud.

Petals 13-15 mm. long; rosette persisting when the plant is mature. *O. muricata.*

Flowers larger than in *O. muricata*; rosette persisting.

O. ammophila.

Flowers very small; petals 8 mm. long; rosette not persisting.

O. parviflora.

Petals broad; flowers large; style long (except in *O. brevistylis*, which has a very short style), protruding the stigma beyond the stamens and preventing self-pollination before the bud opens.

Flowers large, about 7 cm. or more in diameter; style very long, so that the stigma protrudes from the bud before the latter opens (as is often true also of the buds of *O. Lamareckiana* and *O. grandiflora* in the latter part of the season); calyx glabrous. Rosette leaves nearly glabrous, long, linear or linear-spatulate, sinuate. *O. argillicola.*

Flowers about 7 cm. in diameter; style short, so that the stigma is surrounded by the anthers, as in *O. biennis*. *O. Simsiana.*

Flowers about 7 cm. in diameter (or larger in *O. gigas*); style longer than in *O. biennis*, so that the stigma is protruded beyond the stamens, but enclosed in the bud, except in some cases in the later and smaller buds of the season.

Buds smooth, with an inconspicuous pubescence of short hairs; sepals thin and papery; bud-cone slender, about 6 to 7 mm. in diameter at the base, and rounded owing to thinness of sepals and less prominence of the median longitudinal ridge of the sepals; sepal tips usually long and very slender. Red glands on stem present or absent.

O. grandiflora and its segregates.

Buds papillate, with numerous long and short hairs; sepals somewhat thicker than in *O. grandiflora* and median ridge more prominent, giving a characteristic squarish appearance to

the buds; sepal tips awl-shaped, stouter than in *O. grandiflora*.
Red glands always present on stems.

O. Lamarckiana and its segregates.

KEY TO THE LAMARCKIANA FORMS.

- Rosette leaves, and to a lesser extent in some cases, stem leaves crinkled.a
 Rosette and stem leaves nearly or quite free from crinklingb
 a. Rosette leaves and stem leaves sessile or nearly so. *O. nanella*.
 Rosette leaves and lower stem leaves with petioles.c
 c. Petioles of rosette leaves not margined. *O. oblonga*.
 Petioles of rosette leaves margined.d
 d. Leaves whitish.e
 Leaves green without whitish cast.f
 f. Flowers larger than in *O. Lamarckiana*; bud cone about 9 to 10 mm. in diameter at the base; hypanthium stouter, about 4 mm. in diameter. *O. gigas*.
 Flowers somewhat smaller; bud cone about 7 to 8 mm. in diameter at the base; hypanthium more slender, about 3 mm. in diameter.g
 g. Rosette leaves oblong or fairly broadly lanceolate, crinkled, pointed.h
 Rosette leaves very broad, oblong, with very obtuse tips, lighter green and much crinkledi
 Rosette leaves similar to those of *O. Lamarckiana* (h), but rather broader and with very obtuse, rounded tips. The bracts are also broader than in *O. Lamarckiana*, and the sepal tips very short. *O. brevistylis*.
 h. Blooming at the same time in the season as other forms (in my cultures beginning about the end of July). Ovaries of ordinary shape, 8 to 10 mm. in length.—See short description. *O. Lamarckiana*.
 Blooming later than *O. Lamarckiana* (beginning in my cultures of this year about August 15th). Leaves like those of *O. Lamarckiana*, but closely clothing the stem; branches few; capsules long and thin. *O. leptocarpa*.
 i. Stems often weak and more or less decumbent; buds greenish, rounded, not usually squarish, thick; anthers dry and sterile; petals much crumpled in the bud, making it usually one-sided. *O. lata*.
 Taller than *O. lata*; bud cones less thick than in *O. lata*, more squarish; leaves smaller and less rounded at the point; anthers producing pollen. *O. semilata*.
 b. Petals emarginate or sometimes truncate.j
 Petals elliptical, capsules long and thin.
 Stem low, weak; leaves very small, lanceolate, long and narrow, often ten times longer than broad. *O. elliptica*.
 Strongly branched, less than one metre high; leaves very small, nearly linear. *O. sublinearis*.

- e. Rosette leaves whitish, young rosette otherwise very much as in *O. oblonga*; flowers pale yellow; capsules small with few seeds.

O. albida.

Rosette leaves nearest those of *O. Lamarckiana*, but narrower, usually shorter and less crinkled, usually but not always with midribs rather conspicuously red on the upper surface; stem leaves also frequently with red midribs.

Rosette leaves with petioles usually red above but always green beneath. Sepals usually with red stripes of varying width, but hypanthium and median ridge of sepals always green.

O. rubrinervis.

Rosette leaves with petioles more or less red above but conspicuously red on the lower surface. Calyx deep red throughout, including median ridge of sepals and the whole hypanthium.

O. rubricalyx.

- j. Rosette leaves more narrowly lanceolate than in *O. Lamarckiana*, of normal length, of uniform width for the greater part of their length, usually smooth and free from crinkling; stem leaves smooth, standing out rather straight from the stem, narrow and more or less furrow-shaped; capsules of normal size and shape.

O. laevifolia.

Leaves small, with broad midrib; capsules short and thick, of half normal size or less, smooth. The bud-bearing portion of stalk above the flowers is longer than in other forms. *O. scintillans.*

OENOTHERA BIENNIS Linnaeus.

Oenothera, foliis lanceolatis dentatis caule hispido. Miller, Figures of the most beautiful, useful and uncommon plants described in the Gardeners' Dictionary, etc. 2. pl. 189. f. 1. Plate dated 1757.

Oenothera biennis Linn. Sturm's Deutschlands Flora. 8. pl. 35. Nürnberg. 1812.—Ettingshausen und Pokorný, Physiotypia plantarum austriacarum. 10. pl. 926. Prag. 1873.—Millsbaugh, Medicinal plants. 1. pl. 60. Philadelphia. 1892.

Onagra (Oenothera) biennis (L.) Scop. MacDougal, Mutants and hybrids of the *Oenotheras*. (Carnegie Pub. 24: 9. pl. 3-6). 1905.

The rosettes are various in the different races. Flowers small when open, about 3 cm. in diameter; style short, so that the anthers surround the stigma lobes, and self pollination of the flower invariably takes place before the bud opens, the ruptured anthers being in direct contact with the stigma lobes; buds small and rather pointed, squarish, usually greenish, or with more or less red on the sepals.

This "species" ranges throughout North America and undoubtedly contains a large number of geographic races, most

of which have not yet been isolated. The *O. biennis* which extends over a large part of Europe is still another form, or perhaps series of forms. The small flowers and the short style ensuring self-pollination are characters easily distinguishing it from all the derivatives of *O. Lamarckiana* and *O. grandiflora*.

OENOTHERA OAKESIANA (Robbins) S. Watson.

Vail in "Mutations, variations and relationships of the *Oenotheras*", (Carnegie Pub. 81: 70. *pl.* 15-17). 1907.

This species is very close to *O. biennis*, the main differences enumerated by Robbins being the possession of spreading sepal tips, a longer and more taper capsule and larger seeds. The rosette leaves are oblong-ovate, obtuse, tapering to a white, margined petiole, dull or pale blue-green, nearly glabrous; later rosette leaves more or less strigose-pubescent, narrowly lanceolate, shallowly toothed at acute apex, more deeply notched at the slender, tapering base. Stem leaves narrowly lanceolate, acute and tapering at each end.

OENOTHERA MURICATA Linnaeus.

Flora Danica. *pl.* 1752. 1823.—Reichenbach, Icon. Fl. Ger. et Helv.

23. *pl.* 21. 1898.—Vail in "Mutations, variations and relationships of the *Oenotheras*". p. 73. *pl.* 21, 22. 1907.

The flowers are somewhat smaller than in *O. biennis*, and the style shorter so that the stigma is below the stamens in the bud; buds pubescent with appressed and spreading hairs; rosette persisting when the plant is mature. Rosette leaves approximately denticulate, more deeply so toward the base, with a broad white-margined petiole. Stems angled, turning red and outer bark splitting into shreds at maturity.

OENOTHERA PARVIFLORA Linnaeus.

Meerburg, Plantae rariores. *pl.* 34. 1789. Vail in "Mutations, variations and relationships of the *Oenotheras*". p. 71. *pl.* 18-20. 1907.

Flowers very small; petals 8 mm. long; stigma situated below the stamens in the bud; rosette leaves long and slender, lanceolate or oblong-lanceolate, acutish, dark green and shiny; buds club-shaped with spreading sepal tips.

Rosette leaves lanceolate or oblong-lanceolate, acutish, more deeply notched at the long, tapering base, dark green and shiny, sparingly mottled with red.

OENOTHERA ARGILLICOLA Mackenzie.

MacDougal, *Mutants and hybrids of the Oenotheras*. (Carnegie Pub. 24: 11. *pl.* 7). 1905.

Flowers large, petals 4–4.5 cm. long (3–4 cm. long, Mackenzie); stigma projecting from the unopened bud; buds glabrous (no short hairs?); capsules glabrous, tapering. Rosette leaves glabrous or nearly so, except the sparingly ciliate margins, broadly linear to linear-spatulate, sinuate; petioles relatively stout. Stem very leafy; stem leaves linear-lanceolate.

The "glabrous" buds and capsules of *O. argillicola* apparently bring it nearer to *O. grandiflora* than to any other form.

OENOTHERA SIMSIANA Seringe.

Oenothera corymbosa Sims, Curtis's Bot. Mag. 45. *pl.* 1974. 1818.
Oenothera Simsiana Ser. *Pl.* pub. with Acad. Intern. Géog. Botanique Bull. iii. 9. 1900.—Vail in "Mutations, variations and relationships of the Oenotheras." (Carnegie Pub. 81: 68. *pl.* 13, 14). 1907.

Flowers large, petals 4 cm. long, stigma surrounded by the stamens in the bud; buds densely appressed-pubescent (long hairs?); bud cone tapering only in terminal portion; erect free sepal tips mostly unequal. Rosette leaves oblong to obovate, gradually tapering to the broad petiole, light yellow-green; petiole white. Plant straggling in appearance; stem leaves oblong-lanceolate to lanceolate, acute or acuminate, coriaceous, very brittle, bright yellow-green, soon turning red.

Some of the hybrids between *O. Lamarckiana* forms and *O. biennis*, like *O. Simsiana* have a short style so that the anthers surround the stigma in the bud, but the petals are smaller than in *O. Lamarckiana*.

OENOTHERA GRANDIFLORA Aiton.

Oenothera grandiflora. Barton, *A flora of North America*. 1. *pl.* 6. Philadelphia. 1821.—Probably the most accurate plate. The slender

rounded bud and delicate sepal tips are well represented. The stem leaf in *f. 2* is also correct for *O. grandiflora*, but too broad for *O. Lamarckiana*.—Vail in "Mutations, variations and relationships of the Oenotheras." (Carnegie Pub. 81 : 66. *pl. 11, 12*). 1907.

Usually in cultures a loose rosette of few leaves, or in some cases no rosette at all. Especially when grown in conditions of high temperature and humidity, a much better rosette is formed and the later rosette leaves have a prominent series of basal lobes on each side of the midrib, easily distinguishing them from those of any of the *O. Lamarckiana* or *O. biennis* derivatives. The stem leaves are usually larger and broader than in *O. Lamarckiana* and largely free from crinkling. Flowers large, about 7 cm. in diameter when open; style long, protruding the stigma beyond the anthers and preventing pollination before the bud opens; buds smooth with a small amount of pubescence of *short* hairs; sepals thin and papery, often wrapped more or less diagonally around the bud: buds slender and rounded owing to thinness of sepals and less prominence of the longitudinal median ridge of the sepals; sepal tips usually long and very slender. These bud characters easily distinguish it from *O. Lamarckiana*. Red glands on stem present or absent.

OENOTHERA LAMARCKIANA Seringe.

Oenothera biennis. Sowerby's English Botany. **22.** *pl. 1534*. 1806.—Probably *O. Lamarckiana* rather than *O. grandiflora*, but sepal tips not well represented.

Oenothera grandiflora Sims, Curtis's Bot. Mag. **46.** *pl. 2068*. 1819.—Petals less strongly emarginate and much less cuneate than in this figure.

Oenothera biennis var. *grandiflora* Lindl. Edwards' Bot. Register. **19.** *pl. 1604*. 1833.—Probably *O. Lamarckiana*. Leaf (probably a rosette leaf or one of the lower stem leaves) much too narrowly lanceolate for *O. grandiflora*; sepal tips also too short and stout.

Oenothera Lamarckiana. Floral Mag. **2.** *pl. 78*. 1862.—The reddish buds and stem suggest *O. rubrinervis*.

Oenothera Lamarckiana Lemaire.—Illustration Horticole. **9.** *pl. 318*. 1862.—Copied, reversed, from the Floral Magazine.

Oenothera Lamarckiana Ser. DeVries, Die Mutationstheorie. **1** : 213.. *f. 55*, whole plant; **1** : 227. *f. 61*, flowering shoot; **1** : 228. *f. 62*, rosette leaf; **1** : 229. *f. 64*, young rosette; **1** : 230. *f. 66*, very young; rosette; **1** : 320. *f. 99*, fruits; **1** : 153. *f. 42*, flower nat. size; **1** : 169..

f. 46, buds; **1**: 192. *pl.* 1, colored; **1**: 289. *f.* 89, rosette leaf, bract and terminal rosette; **1**: 378. *f.* 114, dry fruits; **2**: 240. *pl.* 1, colored; **2**: 496. *pl.* 3, colored.

For figures of *O. Lamarckiana* and its mutants, see DeVries, Die Mutationstheorie, 1901 and 1903; Recherches expérimentales sur l'origine des espèces (Rev. gén. de bot. **13**: 5-17). 1901.—MacDougal, Mutation in plants (Am. Nat. **37**: 737-770). 1903. Printed also in Contrib. N. Y. Bot. Garden, no. 48. figs. 8.—MacDougal *et al.*, Mutants and hybrids of the *Oenotheras* (Carnegie Pub. no. 24). 1905: and Mutations, variations and relationships of the *Oenotheras* (Carnegie Pub. no. 81). 1907.

Flowers large, about 7 cm. in diameter, style long, as in *O. grandiflora*. Buds pubescent, with numerous long and short hairs, sepals somewhat thicker than in *O. grandiflora*, and median ridge more prominent, giving a characteristic squarish appearance to the buds. Sepal tips awl-shaped, stouter than in *O. grandiflora*. These numerous characters of the sepals make it possible to distinguish the *O. Lamarckiana* and *O. grandiflora* buds without any difficulty. Although the differences are all purely quantitative in character, yet their summation gives an entirely different aspect to the bud in the two cases.

Rosette leaves usually much crinkled, rather broadly lanceolate, pointed, usually without red on midribs; petiole margined for some distance. A rosette is always formed and the rosette stage usually (in cultures) lasts about four months after the planting of theseeds. Stem leaves crinkled. Red glands on stem and ovaries. Sepals usually green, but sometimes with reddish stripes. The *O. Lamarckiana* forms usually come into bloom later than *O. grandiflora*.

OENOTHERA RUBRINERVIS DeVries.

See under *O. Lamarckiana*. Die Mutationstheorie. **1**: 162. *f.* 43, flowering shoot; **1**: 199. *f.* 49, whole plant; **1**: 207. *f.* 52, rosette leaves; **1**: 209. *f.* 54, rosette leaves; **1**: 231-238. *f.* 67, 68, 70, whole plant; **1**: 320. *f.* 99, fruits; **2**: 496. *pl.* 3, colored.

Rosette leaves narrower, usually shorter and less crinkled than in *O. Lamarckiana*, whitish, and usually but not always

with rather conspicuous red midribs; stem leaves also frequently with red midribs, otherwise very similar to those of *O. Lamarckiana*, not always whitish. Petioles of rosette leaves margined for some distance. Sepals usually with conspicuous red stripes varying in width. Hypanthium green. Stem generally less stout than in *O. Lamarckiana*, usually with more side branches and sometimes slightly zigzag.

Oenothera rubricalyx.

This conspicuous form first originated in my cultures as a mutant from *O. rubrinervis* two years ago. The same identical type has since appeared as one of two types in the F_1 of *O. nanella* pollinated from a certain strain of *O. bien-nis*. In both cases it breeds true except for certain individuals which revert to *O. rubrinervis*, the percentage of reversions being a simple Mendelian ratio in the last case, and possibly also in the first. A full description of this form will appear elsewhere in connection with an account of *Oenothera* cultures.

O. rubricalyx is clearly distinct from *O. rubrinervis* and there are no intermediate forms. The only distinguishing feature of this mutant is its greatly increased production of red pigment (anthocyan). It is differentiated from *O. rubrinervis* in having much pigment on the *under* surface of the rosette leaf petioles, and on the hypanthium as well as the whole of the sepal, including the median longitudinal ridge. This latter makes the buds very conspicuous so that they are distinguishable from *O. rubrinervis* at a glance. There is also an increase in pigment production on the stem and in other parts of the plant.

OENOTHERA LATA DeVries.

See under *O. Lamarckiana*. Die Mutationstheorie. 1 : 169. f. 46, buds; 1 : 220. f. 58, leaf; 1 : 288. f. 88, flowering shoot; 1 : 289. f. 89, rosette leaf, bract and terminal rosette; 1 : 294. f. 91, rosette; 1 : 295. f. 92, rosette; 1 : 321. f. 101, fruits; 2 : 240. pl. 1, colored; 2 : 496. pl. 3, colored.

Rosette leaves very broad, oblong, with very obtuse tips, lighter green and very much crinkled. Stems often weak and more or less decumbent. Buds greenish, rounded and

barrel-shaped, not usually squarish, thick; anthers dry and sterile; petals much crumpled in the bud, arranged so as to make it usually one-sided.

The *O. lata* from Liverpool, England, is a stronger form which has less difficulty in forming a stalk, having buds of normal squarish shape, and producing a considerable amount of good pollen, so that self-pollination can be effected without difficulty. This brings it very close to *O. semilata*, but the characters of the rosette and stem leaves are those of *O. lata* rather than *O. semilata*.

OENOTHERA GIGAS DeVries.

See under *O. Lamarckiana*. Die Mutationstheorie. 1 : 192. *pl.* 2, colored; 1 : 226. *f.* 60, flowering shoot; 1 : 228. *f.* 62, rosette leaf; 1 : 229. *f.* 63, young rosette; 1 : 230. *f.* 66, very young rosette; 1 : 321. *f.* 101, fruits; 2 : 496. *pl.* 3, colored.

Larger than the other mutants in nearly all its parts. Rosettes of very large, crinkled leaves, very variable in shape but usually very broad, sometimes nearly orbicular, sharply narrowed to petiole and much crinkled. Internodes and capsules shorter and thicker than in *O. Lamarckiana*. Bud cone and hypanthium thicker, petals broader. *O. gigas nanella* is a dwarf sub-type of *O. gigas*.

OENOTHERA NANELLA DeVries.

See under *O. Lamarckiana*. Die Mutationstheorie. 1 : 165. *f.* 45, whole plants; 1 : 256. *f.* 77, flowering shoot; 1 : 257. *f.* 78, very young rosette; 1 : 260. *f.* 79, young rosettes; 1 : 267. *f.* 80, buds on stem tip; 2 : 240. *pl.* 1, colored; 2 : 496. *pl.* 3, colored.

Rosette leaves variable in shape, small, usually broad and very obtuse, not much crinkled, sessile or with very short petioles, forming a compact rosette. Internodes very short, so that the plant usually reaches a height of only 10 to 20 cm. Flowers almost full size.

OENOTHERA LAEVIFOLIA DeVries.

Die Mutationstheorie. 1 : 218. *f.* 56, flowering shoot; 1 : 221. *f.* 59, small flowers.

Rosette leaves more narrowly lanceolate than in *O. Lamarckiana*, of uniform width for the greater part of their

length, usually smooth and free from crinkling. Stem leaves smooth, standing out rather straight from the stem, narrow and more or less furrow-shaped. Buds may be greenish, or with a red color pattern as in *O. rubrinervis*.

OENOTHERA BREVISTYLIS DeVries.

Die Mutationstheorie. **2**: 430. *f.* 80, flower; **2**: 431. *f.* 81, flowers; **2**: 431. *f.* 82, parts of flowers; **2**: 434. *f.* 84, whole plant; **2**: 434. *f.* 85, fruits.

Rosette leaves rather broader than in *O. Lamarckiana*, with very broad, obtuse, rounded tips. Bracts of terminal rosettes broader and more rounded at tip than in *O. Lamarckiana*. Style very short, usually not projecting above the calyx tube. Sepal tips very short. Buds may have a red color pattern, as in *O. rubrinervis*.

OENOTHERA OBLONGA DeVries.

See under *O. Lamarckiana*. Die Mutationstheorie. **1**: 163. *f.* 64, flowering shoot; **1**: 200. *f.* 50, whole plant; **1**: 239. *f.* 71, flowering stem; **1**: 244. *f.* 74, young rosette; **1**: 321. *f.* 100, fruits; **1**: 384. *pl.* 6, colored.

Rosette leaves smaller than in *O. Lamarckiana*, oblong with rounded tip, much crinkled, with a long, broad, unmarginated petiole. In my cultures, *O. oblonga* has appeared at various times, especially from crosses, but I have never been able to rear it beyond the rosette stage.

OENOTHERA ALBIDA DeVries.

See under *O. Lamarckiana*. Die Mutationstheorie. **1**: 192. *pl.* 3, colored; **1**: 248. *f.* 75, 76, young rosettes; **1**: 320. *f.* 99, fruits.

Rosette leaves whitish. Young rosette otherwise very much as in *O. oblonga*. Capsules small, with few seeds. Flowers pale yellow. Stems somewhat zigzag and very brittle.

OENOTHERA LEPTOCARPA DeVries.

Only distinguishable in the adult stage from *O. Lamarckiana*, from which it differs in beginning to bloom later in the season, and in having few branches. The leaves are like those of *O. Lamarckiana*, but closely clothe the stem. The capsules are long and thin.

OENOTHERA SEMILATA DeVries.

Taller than *O. lata*. Bud cones less thick than *O. lata*; inflorescence looser and longer; leaves smaller and less rounded at the point. Produces pollen, but less than *O. Lamarckiana*.

OENOTHERA SCINTILLANS DeVries.

Die Mutationstheorie. **1**: 171. *f.* 47, flowering shoot; **1**: 272. *f.* 81, 82, rosettes; **1**: 321. *f.* 100, fruits; **1**: 384. *pl.* 5, colored; **2**: 496. *pl.* 3, colored.

Seedling leaves broadest in the middle, small with broad petiole and midvein, very smooth and glossy, dark green. Leaves small, green, smooth, with broad midvein, whitish. The bud-bearing portion of the stalk above the flowers is longer than in other forms. The capsules are short and thick, half normal size or less; seeds small; fruits smooth.

OENOTHERA ELLIPTICA DeVries.

Die Mutationstheorie. **1**: 281. *f.* 83, shoot, rosette and rosette leaf; **1**: 282. *f.* 84, flower natural size.

Seedling leaves broadest in the middle, very long with long petiole. Stem short and weak. Leaves very small, lanceolate, long and narrow, often ten times longer than broad. Capsules long and thin. Petals elliptical.

OENOTHERA SUBLINEARIS DeVries.

Die Mutationstheorie. **1**: 285. *f.* 85, whole plants; *f.* 86, rosette leaf; *f.* 87, petals.

Seedling leaves of equal breadth throughout the greater part of their length, whitish, little crinkled, scarcely narrowed at the stem, nearly grass-like. Strongly branched (less than one metre high), branches standing out stiffly, mostly very weak. Leaves very small, nearly linear. Capsules long and thin. Petals elliptical.

One other form, whose position is doubtful, may be included in this list.

OENOTHERA AMMOPHILA Focke.

Briefly described in Abh. Nat. Ver. Bremen. **18**: 182-186. 1906.

From the coast near Bremen, Germany.

Rosette leaves small, long, narrowed into a petiole, both sides thickly clothed with appressed hairs. The rosette remains after the stem is formed in the second year. Stems .5-1 m. high. Stem and capsules covered with short, club-shaped (?) hairs. Also scattered long pointed hairs which arise from reddish protuberances. These are evidently the same two types of hairs found in *O. Lamarckiana* and its derivatives and in *O. biennis*. The petals are similar to those of *O. biennis* but smaller, slightly crenate. It is like *O. muricata* in having petiolate rosette leaves and small stem leaves, in its pubescence and the crenate petals; but it differs in having large flowers and longer sepals. It also resembles *O. muricata* in that the rosette of the previous year remains after the stem is formed in the second year. The cultures of MacDougal (Carnegie Pub. no. 81. 1907) have shown that *O. ammophila* may produce bud reversions to *O. biennis*, which makes it probable that *O. ammophila* is a hybrid between *O. biennis* and some other form. The leaves are smaller and narrower than in *O. biennis*.

August 18, 1909.